

Preliminary Bat Inventory of Caves and Abandoned Mines on BLM Lands, Judith Mountains, Montana

A Report to:

Bureau of Land Management
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January 2000



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This document should be cited as follows:

Hendricks, P. 2000. Preliminary bat inventory of caves and abandoned mines on BLM lands, Judith Mountains, Montana. Montana Natural Heritage Program. Helena, MT. 21 pp.

ABSTRACT

The bat fauna of the Judith Mountains, Fergus County, Montana is poorly known. Four visits were made to the Judith Mountains between October 1997 and September 1999, specifically to survey caves and abandoned mines on Bureau of Land Management lands for bats and evidence of bat activity. Attention was focused on Collar Gulch and Tate-Poetter Cave, sites of special biological/resource significance. Eleven individuals of three bat species were captured during the surveys in September 1999: three Western Long-eared Myotis (*Myotis evotis*), seven Long-legged Myotis (*M. volans*), one Townsend's Big-eared Bat (*Corynorhinus townsendii*). Western Long-eared Myotis is a new species record for the Judith Mountains. Each species is a U.S. Fish and Wildlife Service "species of concern" (former C2 candidates for listing under the Endangered Species Act), and Townsend's Big-eared Bat is also a BLM Special Status species in Montana. All species were captured or recorded at Tate-Poetter Cave or nearby at smaller caves or mine workings in Collar Gulch; the first species was also captured at the Whiskey Gulch Mine. Tate-Poetter Cave is cold (35-39°F) and used primarily as a hibernaculum by Townsend's Big-eared Bat; four individuals were observed in the cave April 1998. On previous winter trips, ca. 20 were reported in November 1990 and ten in November 1991. Western Long-eared Myotis was recorded with an electronic bat detector at Tate-Poetter Cave in October 1997. Myotis remains were found in the cave, but Myotis has not yet been observed there during hibernation. Other caves and mines in Collar Gulch were used by more than one bat species as day and night roosts during late summer; winter use of these workings is unknown. No maternity sites were identified during the surveys. Seven other abandoned mine workings visited or surveyed in September 1999 had little or no bat activity associated with them.

Four additional bat species have previously been documented from the Judith Mountains, all in the Maiden area: Little Brown Myotis (*M. lucifugus*), Big Brown Bat (*Eptesicus fuscus*), Silver-haired Bat (*Lasionycteris noctivagans*), Hoary Bat (*Lasiurus cinereus*). None is a U.S. Fish and Wildlife Service "species of concern"; the latter two species are rarely associated with caves or abandoned mines. Species not yet documented that might be present in the Judith Mountains include Western Small-footed Myotis (*M. ciliolabrum*), Yuma Myotis (*M. yumanensis*), and Eastern Red Bat (*Lasiurus borealis*); the two species of *Myotis* are also "species of concern" and use mines for roosts and hibernacula.

ACKNOWLEDGMENTS

The bat surveys reported here were originally proposed and agreed upon by David Genter (Montana Natural Heritage Program) and Michelle Williams (Lewistown Field Office, BLM). The work was funded by a Challenge Cost Share Agreement No. 1422E930A960015 between the Lewistown Field Office, BLM and the Montana Natural Heritage Program—a collaborative effort of The Nature Conservancy and the Natural Resource Information System. A special thanks is due Michelle for her patience in seeing this project reach fruition and for offering direction and focus. David Kampwerth and Sam Martinez participated in (led) the underground surveys of Tate-Poetter Cave and efforts to locate New Year Mine Crystal Cave; Sam shared climate data from two Tate-Poetter trips (in 1998 and 1999). Pete Feighley helped during the first trip to locate Tate-Poetter Cave in October 1997. Mike Roedel and Kristi Dubois participated in the mist-netting and mine exploration in September 1999. Kathy Jurist interpreted recorded bat vocalizations from Tate-Poetter Cave in 1997. A special thanks is due Tom Hanson, who readily agreed to let us cross his property more than once to reach Collar Gulch the easy way. Another special thanks is due the collection managers at numerous museums for responding to requests for records of bats (and other Montana vertebrates) housed in their respective collections; pertinent here is Montana State University at Bozeman and the University of Kansas Natural History Museum in Lawrence.

INTRODUCTION

Several species of North American cave-dwelling bats have been adversely affected in recent decades by a variety of human-induced environmental changes to caves, including cave closures, impoundments, and vandalism or other direct human disturbances (see Humphrey 1978, Tuttle 1979, LaVal and LaVal 1980, Sheffield et al. 1992.). These, and landscape changes such as deforestation (including loss of large trees with basal hollows) and agricultural development, have forced many bat species to abandon traditional sites in search of new roosts and hibernacula. As a result, some cave-dwelling species in the eastern and Midwestern United States are listed as threatened or endangered under the U.S. Endangered Species Act. Several additional species with wide distributions are considered “species of concern” (former C2 candidates for listing) by the U.S. Fish and Wildlife Service (Harvey et al. 1999).

Abandoned mines offer a variety of subterranean microclimates similar to those in natural caves (Tuttle and Stevenson 1978, Tuttle and Taylor 1994) and can provide suitable habitat for roosting and hibernating bats. Abandoned mines now serve as principle roosts and hibernacula for many cave-dwelling species (Tuttle and Taylor 1994), and are important for populations occupying marginal habitats (Gates et al. 1984) in areas where there are continued threats to primary natural roosts. It is widely acknowledged that natural cave environments are the most stable and desirable long-term habitats for bats, but abandoned mines may provide a suitable alternative. Thus, both types of subterranean features deserve management consideration for protection as important bat habitat.

Mine reclamation (including closure to restrict human access) is of interest to wildlife managers because reclamation activities can have significant negative impacts on bat populations (see Sheffield et al. 1992, Richter et al. 1993). It is important that closure is done properly, to minimize disturbance to bats. The majority of bat species in Montana, including most of those likely to occur in the Judith Mountains, use caves and mines. It is important, therefore, to determine the extent and magnitude of mine use by bats in the state, and identify situations where access by humans to abandoned mines can be restricted while maintaining mine attractiveness to bats. It is also important to document the significance of caves to bats in areas where mine closure is anticipated, and where caves may offer the only secure roosting habitat.

Increased concern over bat populations nationally, coupled with increased emphasis on the closure of abandoned mines on public lands in Montana, has prompted Bureau of Land Management (BLM) biologists to assess abandoned mines for bat activity prior to mine closure (e.g., Hendricks 1997, 2000; Hendricks et al. 1999). In some situations where caves are also present, baseline counts and sampling at caves have been initiated for future monitoring and possible management or mitigation activities (e.g., Hendricks 1998, Hendricks et al. 2000). One cave/mine-dwelling species reported from the Judith Mountains, Townsend’s Big-eared Bat (*Corynorhinus townsendii*), is a designated Special Status species by the BLM in Montana, a “species of concern” by the U.S. Fish and Wildlife Service, and a high priority species by the Western Bat Working Group.

During the 1997-1999 surveys, special attention was given to Collar Gulch and Tate-Poetter Cave. The stream in Collar Gulch harbors an isolated population of Westslope Cutthroat Trout (*Salmo clarki lewisi*). Collar Gulch also is the location of Tate-Poetter Cave, a significant cavern not listed in Campbell’s (1978) compendium of Montana caves, but since described in some detail in several unpublished reports (Campbell no date, Madson 1990, Sasse 1991). Tate-Poetter Cave is a documented hibernaculum for Townsend’s Big-eared Bat. Both the bat and trout are BLM Special Status

species in Montana; each could be affected by future mineral exploration or recreational activity in Collar Gulch. Motor vehicle access to Collar Gulch from Maiden has been restricted somewhat through the installation of a locked gate in 1997. Monitoring of the trout population is routinely conducted, but use by bats of the Collar Gulch area has received little attention, and there have been no counts of wintering bats in the cave since 1991. Furthermore, other abandoned mine workings on BLM lands in the Judith Mountains have not been inspected for evidence of use by bats.

Objectives of the 1997-1999 bat inventory on BLM lands in the Judith Mountains were to 1) resurvey Tate-Poetter Cave for bat activity and determine cave vulnerability to unauthorized human entry, 2) identify specific mine workings used by bats, with special emphasis on the Collar Gulch area where Tate-Poetter Cave occurs, 3) capture and identify bat species using caves and abandoned mines in the project area, 4) provide a list of documented species and those that might occur in the Judith Mountains, and 5) note future survey and monitoring needs.

STUDY AREA AND METHODS

The Judith Mountains are in the Belt Mountains Section ecological unit of the U.S. Forest Service Northern Region (Nesser et al. 1997), and more narrowly, in the Little Belt/Snowy/Judith Mountains subsection. This subsection has a cold continental climate characterized by a warm, dry summer and a cold, dry winter. Mean annual precipitation ranges from 13-42 inches (33-106 cm), with about 40-60% falling as snow. Uplifted mountains that formed predominantly in sedimentary rock (limestone, sandstone, shale) include igneous intrusions that are exposed at higher elevations (Alt and Hyndman 1986). Natural vegetation in the Judith Mountains is dominated largely by Douglas-fir and lodgepole pine forest.

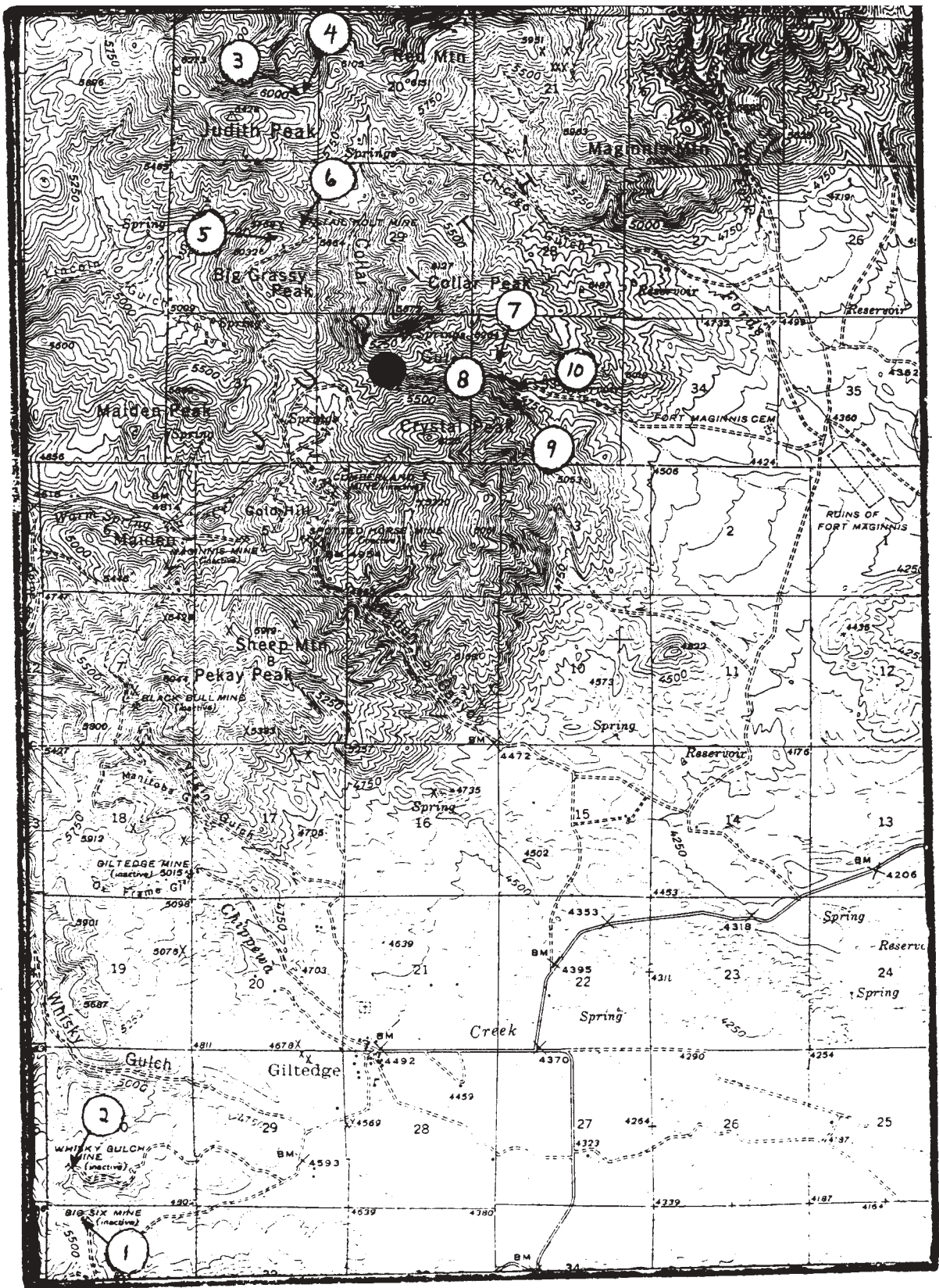
The Judith Mountains are an isolated mountain range, rising about 2000 ft (610 m) above the central-Montana plains of Fergus County; maximum elevation is 6428 ft (1960 m) at the summit of Judith Peak. They have been actively explored for gold since about 1880; numerous abandoned mine workings litter the landscape. The majority of abandoned workings are on patented claims and not under BLM jurisdiction. Several caves are also present, the majority occurring in the Madison Group limestone of Mississippian age (Campbell no date).

Visits to the Judith Mountains were taken on 9-10 October 1997, 19-20 April 1998, 29 May 1999, and 12-17 September 1999 to survey Tate-Poetter Cave and abandoned mines on BLM land for evidence of bat activity. Location of caves and mine workings visited (Fig. 1) were obtained directly from U.S.G.S. 15' topographic maps and BLM land-ownership maps. For each mine site visited, the presence or absence of open portals was the first variable noted. If a mine working had not collapsed, then the dimensions of each opening were measured or estimated, any obstructions (grating, cable netting, fallen timbers or rock, etc.) noted, and if accessible the entrance was inspected for bat spoor (primarily droppings). Temperature of outward air flow, if present, was also measured. Dominant cover-type of the surrounding habitat at mines was classified following a standardized scheme used by Montana Partners-In-Flight for point-count monitoring of birds (Hutto and Young 1999).

Bat detectors (ANABAT II; Titley Electronics, Ballina, Australia), mist nets, and/or harp traps were deployed at workings where spoor was present or the mine working otherwise appeared potentially suitable for bats. Detector units (consisting of an ultrasound detector, timer/tape-driver, and a voice-activated cassette tape recorder) were set before dusk facing portals or aimed across shafts, and left in place overnight. Recorded calls were analyzed on an IBM compatible PC using ANABAT II zero-crossings analysis interface module (ZCAIM) and software.

Assignment of vocalizations to a particular species of bat was achieved by matching time-frequency structure of field recordings with a reference set of calls obtained from captured individuals and published descriptions of vocalizations (e.g., Fenton et al. 1983, O'Farrell 1997). However, bat species can show significant variation in call structure (Betts 1998, Barclay 1999), and we did not actively track and record flying bats (O'Farrell et al. 1999) to maximize quality and quantity of diagnostic sequences. Furthermore, units recorded bats exiting roosts or flying near potential roosts. Roost-exit calls and calls in high clutter tend to be fragmentary, lacking diagnostic features necessary for species identification (O'Farrell 1999). Therefore, all species-level identifications based on recorded vocalizations, where made in this study, are considered tentative.

Figure 1. Mines and caves on BLM lands in the Judith Mountains, Fergus County, Montana surveyed for bat use during the 1997-1999 inventory. Numbers correspond to descriptions in the text: (1) Big Six Mine, (2) Whiskey Gulch Mine, (3) “Unnamed Judith Peak Prospect #1”, (4) “Unnamed Judith Peak Prospect #2”, (5) “Upper Tail Holt Mine”, (6) Tail Holt Mine, (7) “Collar Gulch Prospect”, (8) “Collar Gulch Cave”, (9) Tate-Poetter Cave, (10) “Collar Gulch Adits”. The New Year Crystal Cave Mine, visited in 1998, is not shown. The filled circle represents the central location of an isolated population of Westslope Cutthroat Trout in Collar Gulch and the site of evening mist-netting for bats on 13 September 1999.



Myotis designations (as a group) were assigned to recordings with vocalizations of short duration (< 3 msec) with a relatively linear, perpendicular call pattern. Where call sequences were assigned to *M. evotis* the sweep pattern ranged from a maximum 90 kHz to a minimum 35-40 kHz. Otherwise all were classified *Myotis* species. Calls with a bilinear (extreme curvilinear) pattern were tentatively assigned to a non-*Myotis* species or classified as unknown bat. Passes with call fragments were also designated unknown bat if no associated calls allowed finer resolution. Bilinear call sequences were assigned to *Eptesicus fuscus* if a continuous frequency tail ranged from 33-28 kHz. This could result in confusion with *Lasionycteris noctivagans* (Betts 1998), which has a similar call structure, but most of our recordings were made at the mouths of mines where the latter species is unlikely to occur. Nevertheless, few bilinear calls were recorded, and none could be assigned to either species. Number of “passes” (defined here as a distinct vocalization with at least a 1 sec gap between prior and following vocalizations) was recorded as a measure of relative activity at each site. At five sites with bat activity, equipment malfunctioned prematurely. Therefore, relative activity as presented here is useful primarily as an index with variable degrees of error.

Bats were captured using 50-denier mist nets of various lengths (most often 2.8 and 6 m) and set in a variety of arrays across portals, depending on site morphology. Nets typically were operated for about 2.5 hours (dusk until 22:00). Captured bats were identified with aid of keys in van Zyll de Jong (1985) or Nagorsen and Brigham (1993). Individuals were sexed, aged, measured (forearm, weight), reproductive status noted, then released.

RESULTS

The sequence of sites presented and discussed below follows the numbering pattern in Figure 1. The exception is the New Year Mine Crystal Cave, which is not in the map area displayed; this site will be discussed at the end of the Results section.

1. **Big Six Mine** (T16NR20ES31NWNW). This working (5500 ft elev.), about 1 mile S of Whiskey Gulch, is unsuitable for bats in its current condition (checked on 15 September 1999). The working has been reclaimed with a gated culvert inserted in the mine portal. The gate is locked, and the portal is further blocked with a large boulder. The suitability of this site for bats, if the entrance was modified to make it bat-friendly, is unknown. No airflow was detected at the portal.

2. **Whiskey Gulch Mine** (T16NR20ES30NWSW). This mine site (ca. 5350 ft elev.) encompasses a number of workings, mostly smaller pits that probably were older adits before being excavated, as well as remains of a mill site and associated buildings, that are spread over several hundred feet of hillside in Douglas-fir/lodgepole pine forest.

Three significant open portals were found. There is a fenced area (Department of State Lands, Abandoned Mine Reclamation sign) containing a pit, in which a portal (“#3”) leads into an adit of unknown length. This portal is partly blocked with rock and wood debris that has fallen from the slopes of the pit. Portal #3 is about 13.1 ft (4 m) vertical above and ca. 98.4 ft (30 m) horizontal from Portals #1 and #2, the other two open underground workings at this mine site. These latter two portals are gated and lead to adits at least 10 m in length each. The gates are metal with a mesh size 7.5 in wide x 8.3 in tall (19 x 21 cm). Each gate frame is in a brick and mortar wall flush with the edges of the adit portal. Portal #1 (to the right or SE) is 3.0 x 3.0 ft (0.9 x 0.9 m) in height and width, and bends left into the hillside after running straight and level for 32.8 ft (10.0 m); it may connect to Portal #3. Cold air (47°F near ground level, 50°F near the ceiling) flowed out of the portal at 13:45 on 16 September 1999 (ambient air = 72°F at the time and 58°F at dusk on this date) and into the adit in early morning. Portal #2 is about 6.6 ft (2.0 m) to the NW (left) of Portal #1; the adit behind the gate is 3.9 x 3.0 ft (1.2 x 0.9 m) in height and width, and extends 32.8 ft (10.0 m) nearly level and perpendicular to the workings behind Portal #1. No side workings were visible from the gate. There was a slight flow of air out of this portal. An ANABAT detector was left overnight at the mouth of Portal #3 on 16 September, portals #1 and #2 were netted for 2.5 hours (19:30-22:00 MDT) that same evening. Three male Western Long-eared Myotis (*Myotis evotis*) were captured (Table 1, Appendix 1) at the mouth of Portal #1, the first (outside going in) at 20:20, the first bat activity noted that evening, and the last at 20:50 from inside the adit going out. During the netting session more than 25 passes were heard on a bat detector, lasting until nets were removed; many passes were made up to the nets, without successful captures however. These bats may have been the same ones captured that were also hunting over the area, or could have been additional individuals. No bats were captured at the mouth of Portal #2, and none were seen flying up to the net across that portal even though it was immediately adjacent to Portal #1. Overnight, 18 passes by unknown bat species (11) or unidentified *Myotis* (7) were recorded on the detector at Portal #3.

Table 1. Bats observed (visual, netted) or detected (bat detector) at cave, mines, and other sites during the 1997-1999 surveys on BLM lands in the Judith Mountains, Montana. Detector results are number of passes, not number of individual bats. Numbers following sites correspond to site numbers in Figure 1 and text.

Site (#)	Date	Bat Species	Number and Detection Method
Whiskey Gulch Mine (2)	16 Sep. 99	<i>Myotis evotis</i> <i>Myotis</i> sp. Unknown	3 n (portal #1) 7 d (portal #3) 11 d (portal #3)
“Upper Tail Holt Mine” (5)	14 Sep. 99	<i>Myotis</i> sp.	3 d (portal #1)
Tail Holt Mine (6)	14 Sep. 99 15 Sep. 99	<i>Myotis</i> sp. <i>Myotis</i> sp.	4 d (portal #1) 2 v, 4 d (portal #2)
“Collar Gulch Prospect” (7)	13 Sep. 99	Unknown	1 d
“Collar Gulch Cave” (8)	14 Sep. 99	<i>Corynorhinus townsendii</i>	2 v (day roosting)
Tate-Poetter Cave (9)	9 Oct. 97 19 Apr. 98 29-May-99	<i>Myotis evotis</i> <i>Myotis</i> sp. <i>Corynorhinus townsendii</i> <i>Corynorhinus townsendii</i>	1 d 2 d 4 v (hibernating) 1 v (flying)
“Collar Gulch Adits” (10)	29-May-99 12 Sep. 99 13 Sep. 99	Unknown <i>Myotis volans</i> <i>Corynorhinus townsendii</i> <i>Myotis</i> sp. <i>Corynorhinus townsendii</i>	“a few” v 7 n 1 n 1 v (day roosting) 1 v (day roosting)
Collar Gulch, over creek	13 Sep. 99	<i>Myotis</i> sp.	3 d/v

3. **“Unnamed Judith Peak Prospect #1”** (T17NR20ES19NESE). This working (ca. 5880 ft elev.) is shown on the Judith Peak Quadrangle (USGS 7.5 minute, 1985 provisional edition) as the upper of two prospects on the NE side of Judith Peak. The site was visited on 14 September 1999. Collapsed remains of a building are at the site. The working itself is collapsed or filled at the portal behind an old headframe and is unusable by bats.

4. **“Unnamed Judith Peak Prospect #2”** (T17NR20ES19NESE). This working (ca. 5840 ft elev.) is shown on the Judith Peak Quadrangle (USGS 7.5 minute, 1985 provisional edition) as the lower of two prospects on the NE side of Judith Peak. The site was visited on 14 September 1999 and was found to be collapsed or filled at the portal, and not accessible to bats.

5. **“Upper Tail Holt Mine”** (T17NR20ES30SENE). This mine working is at the NE end of the Big Grassy Peak ridge crest, where the crest road terminates (5900 ft elev.). The working consists of a fenced open shaft on the ridge crest, and a mostly collapsed portal at an adit down-slope to the NE. The shaft is vertical with portal and shaft dimensions (length and width) of 13.1 x 13.1 ft (4 x 4 m). A metal ladder of welded rebar is anchored to a corner post of the fence and appears to descend to the bottom of the shaft (ca. 32.8 ft [10 m]). The adit portal down-slope from the shaft is mostly collapsed, with dimensions (height x width) of 0.7 x 2.0 ft (0.2 x 0.6 m) and opening up into a declining passage beyond (filled partly from slumping). Cold air (42°F) flowed out of the portal at 10:50 on 15 September 1999, when ambient temperature was 64°F. Orientation of the drift, spatial position, and the airflow indicate the adit is probably connected to the uphill shaft. No bat droppings were noted near the adit portal.

An ANABAT detector was set to record activity at the shaft during the night of 14 September. Three passes by *Myotis* species were recorded, the first at 19:53 MDT. Netting could not be conducted at this site, and attempts to visually monitor the shaft on the next evening (15 September), to determine if bats were using the site as a day or night roost, were hampered by wind.

6. Tail Holt Mine (T17NR20ES30SENE). This mine site (ca. 5680 ft elev.) on the NE shoulder of Big Grassy Peak is down-slope to the NE from the previous workings. It includes the numerous exploration pits and trenches in lodgepole pine forest around the site marked “Mines” on the Judith Peak Quadrangle (USGS 7.5 minute, 1985 provisional edition). The site is easily approached by road from the low point between Big Grassy Peak and Judith Peak (point 5662). Up-slope from the road is a fenced open shaft (portal #1) with a ventilation pipe protruding above the ground surface; this portal appears to be a collapsed ceiling into a stope or other workings. The opening (ca. 4.9 x 6.6 ft [1.5 x 2.0 m]) is mostly blocked with debris (tree branches, tarp, wire mesh fencing). This opening is about 100 ft (31 m) above the main access to this mine, an open adit (portal #2) with a wooden locked door. The mine is experiencing some human activity (there is a 1997 claim on this mine at the portal, and some activity was witnessed when the site was visited during the survey). The adit is accessible to humans (and bats) to the side of the door when the door is closed. Water is flowing out of the adit; air flowing out of the adit was 43°F at 10:00 on 15 September, when ambient temperature was 64°F. It is 68 ft (20.8 m) from the portal to a large pool of standing water in the adit, and the open drift extends and unknown distance beyond the pool edge. Down hill about 300 ft (100 m) to the WNW of this portal, along a road at an old building site, is another adit (portal #3) that is completely collapsed or filled. This may have been connected underground to the other workings. The two open portals were the only ones found during extensive traverses of the hillsides around the Tail Holt Mine site.

An ANABAT detector left overnight on 14 September 1999 at portal #1 (the “shaft”) recorded 4 passes by bats, all unidentified *Myotis*, between 19:25 and 22:00. On 15 September 1999, two mist-nets (one 6 m and one 2.8 m) were set (19:40-22:00) along and across the water outflow from portal #2. No bats were captured, but during that time bats made 4 passes nearby (between 20:40-20:53). Two unidentified *Myotis* were seen at 20:30 foraging along the road above this portal.

7. “Collar Gulch Prospect” (T17NR20ES33SWNW). This prospect (4800 ft elev.) in Collar Gulch, on the N side of the creek bottom, is a short distance below the Collar Gulch road. It is about 1300 ft (400 m) W of the prospect site shown on the Judith Peak Quadrangle (USGS 7.5 minute, 1985 provisional edition). The prospect is a damp pit (or small shaft) about 18 ft (6 m) deep abutting a limestone outcrop and below a building-like structure of logs open on the N side. The pit has two drifts (steep declines) that extend 6.5 ft (2 m) and 13 ft (4 m) beyond the initial 6.5 ft (2 m) drop (accessible by wooden ladder). Portal dimensions (length x width) are 19.5 x 13 ft (6 x 4 m). The site has been worked relatively recently (1997?), but apparently not since then. No bat droppings were found at the site.

An ANABAT detector left overnight on 13 September 1999 recorded 1 pass (at 23:09) by an unidentified species of bat.

8. **“Collar Gulch Cave”** (T17NR20ES33SEW). This small unnamed cave (4760 ft elev.), not listed in Campbell (1978) nor Campbell’s undated report “Speleological inventory and evaluation of the Judith Mountains”, overlooks the creek bed in Collar Gulch. The mouth is 9-13 ft (3-4 m) above the base of the prominent vertical cliff shown on the Judith Peak Quadrangle (USGS 7.5 minute, 1985 provisional edition), on the N side of the creek bed about where the first “P” in the word “Prospect” is printed on the map. The mouth, just above and behind a small patch of brush, is about 5 x 4 ft (height x width) and leads into a steeply ascending damp passage that eventually levels out, then descends and tightens to a clay-filled floor about 33 ft (10 m) from the entrance. At least three areas in the ceiling open and extend vertically 6-10 ft. Two Townsend’s Big-eared Bats (*Corynorhinus townsendii*) were seen roosting on the wall in the first of these ceiling pockets at 08:30 on 14 September 1999.

9. **Tate-Poetter (= Tate-Potter) Cave** (T17NR20ES33NEW). This cave (ca. 4880 ft elev.) is a significant natural feature in the Judith Mountains. It is not discussed in Campbell (1978), but unpublished reports (Madsen 1990, Sasse 1991) provide details of cave structure (see also Fig. 2). The cave is on the S side of Collar Gulch opposite and above the prospect site (# 10 “Collar Gulch adits” in this report) on the Judith Peak Quadrangle (USGS 7.5 minute, 1985 provisional edition). The cave mouth is a small entrance pit, about 2.5 ft (0.75 m) diameter in dense Douglas-fir forest, that leads to about 1000 ft (305 m) of passage. The cave drops a total of about 200 ft (61 m) and is cold year-round. On a 19 April 1998 visit, dry-bulb temperature throughout the cave ranged from 35.0-37.5°F, except for a small domed alcove in the low point of the Talus Room (Fig. 2), where it was 41.0°F. Relative humidity was 76-86% throughout. The temperatures below the first drop were about 1.0-2.0°F warmer on a 29 May 1999 trip. There was a significant flow of cold air out of the cave mouth at 17:40 on 12 September 1999. Bat guano is scattered throughout the cave, but is sparse in some areas. There are also skeletal remains of a Bushy-tailed Woodrat (*Neotoma cinerea*), a large bovine, and bat finger bones near the wall in the first room at the bottom of Pit 3 and in the Talus Room. An older hand-held flashlight and battery were present in the passage leading down into the Talus Room, but there was little evidence of human presence in the remainder of the cave.

The objective of the first visit to the cave, on 9 October 1997, was to locate the cave and monitor activity at the mouth. An ANABAT detector was left overnight and recorded 3 passes by bats, 1 *Myotis evotis* and 2 *Myotis* species (Table 1), between 18:50-20:30 MDT, before the batteries died. A complete survey of the cave for hibernating bats was undertaken on 19 April 1998. On this date 1 Townsend’s Big-eared Bat (*Corynorhinus townsendii*) was hibernating about 15-20 ft above the cave floor near the top of pit #7 (Fig. 2), and 3 Townsend’s Big-eared Bats were hibernating 6-20 ft above the cave floor near the top of pit #8. No other bats were noted, but several could have been overlooked, because the ceiling of the cave is very high and narrow and could have obscured additional individuals in the lower portion of the cave. Madson (1990) reported about 20 big-eared bats scattered in the cave between the top of the narrow canyon-like passage and the top of pit #8 on 24 November 1990. Sasse (1991) reported 8 big-eared bats on 10 November 1991 on a wall above pit #8 opposite where they were seen in 1998. Sasse also found 2 big-eared bats in the small alcove at the bottom of the Talus Room, where slightly warmer air is trapped (see above). On the 29 May 1999 trip no bats were observed in the cave, except for one big-eared bat flying in the upper part of the cave.

10. **“Collar Gulch Adits”** (T17NR20ES33SEnw). These 3 “adits” in Collar Gulch (4760 ft elev.) are located at the site prospect marked on the Judith Peak Quadrangle (USGS 7.5 minute, 1985 provisional edition), on the N side of the creek bed. The road into Collar Gulch leads to some abandoned wooden buildings slightly down-slope and E of these portals on the E end of the prominent cliff above the creek bed. The eastern-most portal is the lowest; the western-most is highest. The middle portal is behind and largely blocked by a small tree. The lowest portal is largest, 5.9 x 4.3 ft (height x width), the other portals are about half this height. The three portals lead to a single underground working with about 215 ft (65 m) of workings. The drift behind portal #1 (lowest) goes in level for 38.4 ft (11.7 m) where it intersects the workings ascending to the other two portals. Mine dry-bulb temperature was 56-58°F (60% relative humidity) at 10:45 on 13 September 1999, when ambient temperature was 54°F. The mine is dry. Mark Hannah and Dave Plummer (Sam Martinez pers. comm.) reported an unspecified number of unidentified bats in this mine on 29 May 1999. During exploration of the mine on 13 September 1999, a single unidentified *Myotis* was found day-roosting (Table 1) at the intersection of the passages behind portals #2 and #3 (mine temperature = 58°F at this location), wedged into a small crack in the ceiling. A single Townsend’s Big-eared Bat (*Corynorhinus townsendii*) was hanging from the wall near the ceiling 14.8 ft (4.5 m) downslope in the main working from the other bat. Scattered bat guano was found throughout the mine, none in concentrations, and Bushy-tailed Woodrats (*Neotoma cinerea*) were also seen and their droppings noted. The previous evening (12 September) the three portals were netted from 19:45-22:00. One male Townsend’s Big-eared Bat was captured exiting the upper portal at 19:57 (Table 1, Appendix 1). One male Long-legged Myotis (*Myotis volans*) was captured exiting the upper portal at 20:05 and another male was caught entering this portal at 20:49. No bats were captured at the middle portal (blocked by the tree). At the lowest portal, three male Long-legged Myotis were captured exiting the mine between 20:05 and 20:25. Two more male Long-legged Myotis were captured entering this portal at 20:42 and 20:45. No bats were captured after 20:49, but additional passes occurred at 21:15, 21:18, and 21:28. Ambient temperature at the start of netting was 43°F, and was 36°F when nets were closed.

Collar Gulch (stream site) (T17NR20ES32SEnw). This site (4920 ft elev.), on the Collar Gulch stream just up-drainage and down-slope from the old mill site (see Fig. 1), was netted from 19:45-22:00 on 13 September 1999. Two 6 m nets and one 2.6 m net were strung across the creek in riparian birch and Douglas-fir woodland; the sets were about 30-40 ft apart. ANABAT units were used during netting to indicate when bats were nearby. Only 3 passes occurred during the netting session (Table 1; at least one by an unidentified *Myotis*), and no bats were captured. Ambient temperature at the start of netting was 47°F, and was 41°F when nets were closed.

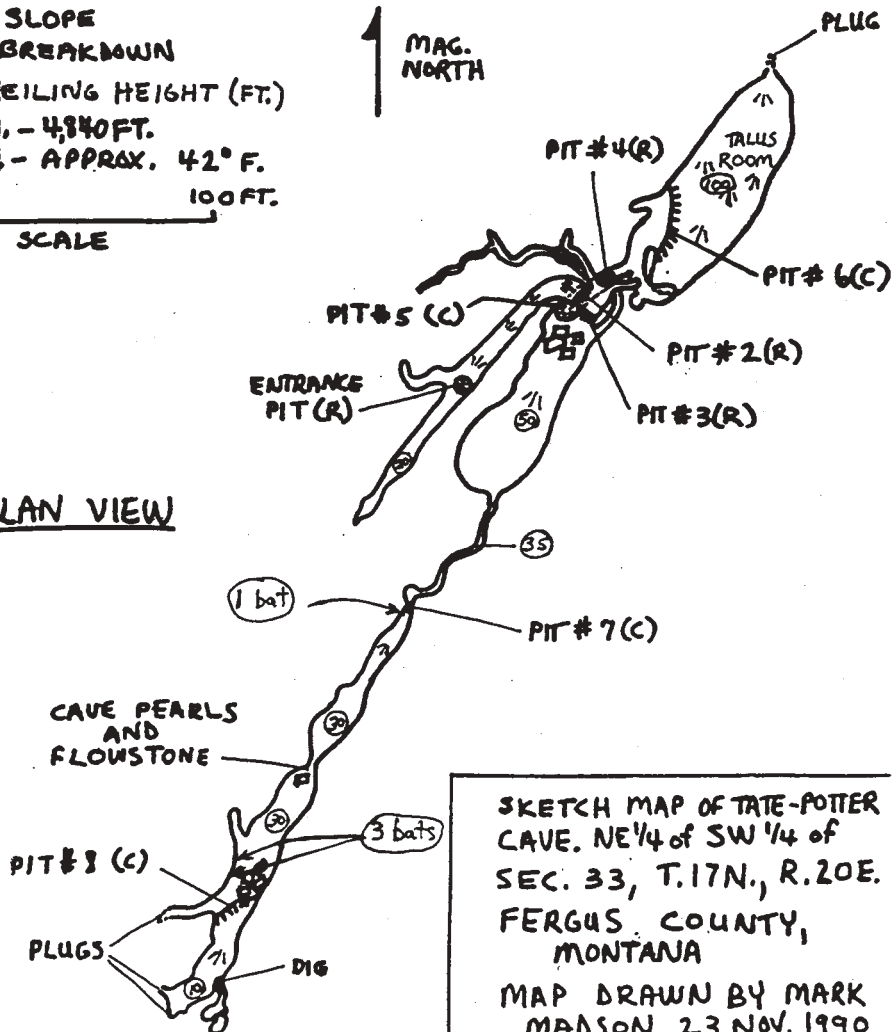
New Year Mine Crystal Cave (T16NR19ES16SWNE). This mine/cave site, above New Year Gulch near the lower of two prospects marked in a narrow gully on the New Year, Montana quadrangle (1985 provisional edition) was visited on 20 April 1998. The portal was completely blocked by a wooden door, making the mine inaccessible to bats. The portal behind the obstruction was very small, requiring excavation to make it accessible to humans. Careful study of topographic and land ownership maps reveals this mine may be on a patented claim, or else is on state land. Further work at this site is not warranted unless land ownership changes.

Figure 2. A plan view of Tate-Poetter Cave, drawn by Mark Madson (1990). Location of hibernating Townsend's Big-eared Bats (*Corynorhinus townsendii*) on the 19 April 1998 trip are indicated with arrows.

Ⓢ or ⓔ - PIT
 (R) - ROPE REQUIRED
 (C) - CLIMBABLE
 11 - SLOPE
 55 - BREAKDOWN
 Ⓢ - CEILING HEIGHT (FT.)
 ELEV. - 4,840 FT.
 TEMP. - APPROX. 42° F.
 0 100 FT.
 SCALE

↑
 MAG.
 NORTH

PLAN VIEW



SKETCH MAP OF TATE-POTTER
 CAVE. NE 1/4 of SW 1/4 of
 SEC. 33, T.17N., R.20E.
 FERGUS. COUNTY,
 MONTANA

MAP DRAWN BY MARK
 MADSON, 23 NOV, 1990.

ALL DISTANCES AND
 DIRECTIONS ARE APPROX-
 IMATE.

DISCUSSION

Tate-Poetter Cave and Collar Gulch: The data reported in the 1997-1999 survey confirm what is indicated in reports by Madson (1990) and Sasse (1991); Tate-Poetter Cave, near the mouth of Collar Gulch, is primarily a hibernaculum for a resident population of Townsend's Big-eared Bats (*Corynorhinus townsendii*). The over-wintering population using the cave appears to have fluctuated in the past, from about 20 individuals in 1990 (Madson 1990) to 4 individuals observed during the 1998 survey reported here (Table 1). However, Tate-Poetter Cave has a high ceiling, with many cracks and obstructions where hibernating bats could be overlooked. It seems premature, therefore, to draw any specific conclusions about the size and trend of the over-wintering population of big-eared bats in this cave.

Over-wintering bats have been reported in places within the cave where other surveys have not found them. For example, Sasse (1991) reported two using the lowest part of the Talus Room (see Fig. 2) in November 1991, but none were there in April 1998. Also, Sasse (1991) reported 10 on the wall above pit #8 opposite where 3 were noted in April 1998. In the April 1998 survey, a single individual was present near the top of pit #7 where none were reported in 1991. However, all of the ca. 20 individuals mentioned by Madson (1990) during their November 1990 trip were present in the area between the first room to pit #8, where Sasse (1991) noted none. Therefore, the available data do not present a clear indication of which portions of the cave are used most by bats during winter.

Few reports document surveys for bats in Tate-Poetter Cave other than during winter. Seasonal use of the cave by bats is inferred largely from cave climate data and a single spring survey. Only one bat was noted in the cave (actively flying in the upper, warmer parts) on the 29 May 1999 trip. Temperature data collected then, and during winter trips, indicate that Tate-Poetter Cave is probably too cold and humid for use as a maternity site by Townsend's Big-eared Bat (see discussions in Humphrey and Kunz 1976, Betts 1997). Instead, most female bats of all species (including Townsend's Big-eared Bat) raising developing young in the Judith Mountains probably use natural cavities in trees and outcrops, or in buildings, where warmer temperatures occur (e.g. Humphrey and Kunz 1976, Dobkin et al. 1995, Bogan et al. 1996, Vonhof and Barclay 1996, Kalcounis and Brigham 1998, Ormsbee and McComb 1998, Rabe et al. 1998, Williams and Brittingham 1997). The same climate conditions make the cave ideal for use as a hibernaculum, however. High relative humidity reduces water loss and desiccation while bats are inactive, and staying torpid in low temperatures reduces metabolic costs and use of fat stores when food is scarce or unavailable.

The temperature range in Tate-Poetter Cave (35-40°F) is similar to those reported for Townsend's Big-eared Bat hibernacula in northern California (Pierson et al. 1991), Idaho (Genter 1986), Kansas (Twente 1955), Oklahoma (Humphrey and Kunz 1976), and elsewhere in Montana (Hendricks 1999, Hendricks et al. 2000), but not as warm as in other parts of its range (summary in Webb et al. 1996). However, Tate-Poetter Cave is unlike Azure Cave in the nearby Little Rocky Mountains, which is a hibernaculum mostly for Little Brown Myotis and Long-legged Myotis (Hendricks et al. 2000). No species of *Myotis* have yet been documented in Tate-Poetter Cave during winter.

Field work in 1999 documented use by Townsend's Big-eared Bats of other underground cavities in the area of Tate-Poetter Cave in Collar Gulch. Two sites in particular (Fig. 1), "Collar Gulch Cave" (site #8) and "Collar Gulch Adits" (site #10), were used as day roosts in September. It is likely that the population of Townsend's Big-eared Bats that is tied to Tate-Poetter Cave uses all of these sites

in Collar Gulch (and probably others as yet undocumented) during the annual cycle. However, pattern of use for sites other than Tate-Poetter Cave is mostly unknown. The spatial distribution of these sites relative to each other is well within the range of movement by Townsend's Big-eared Bat (Dobkin et al. 1995), which may move as much as 24 km after emerging from hibernacula. The co-occurrence of Long-legged Myotis (*Myotis volans*) at the "Collar Gulch Adits" is further indication of the value of this site for bats as a day and night roost. Townsend's Big-eared Bat and Long-legged Myotis are listed as "species of concern" by the U.S. Fish and Wildlife Service (Harvey et al. 1999). Sites used by each merit additional study to determine the timing and magnitude of use.

Other Sites: Few of the other BLM sites surveyed for use by bats during the 1997-1999 inventory appear to be significant to the bats in the Judith Mountains. The notable exception is the Whiskey Gulch Mine (Fig. 1). Western Long-eared Myotis (*Myotis evotis*) was captured in September 1999 at open portals of this abandoned mine (Table 1). This species, previously unreported for the Judith Mountains (Table 2), is also a U.S. Fish and Wildlife Service (USFWS) "species of concern" (Harvey et al. 1999). The Whiskey Gulch Mine merits additional survey work in other seasons to determine the timing and magnitude of use. Other bat species could also use this mine as a day roost and possibly a maternity roost, although measurement of mine air temperature at the portal suggests the workings may be too cold or marginal (47-50°F) for raising young.

The mine workings on Big Grassy Peak (Tail Holt and "Upper Tail Holt" mines) may be used, but to a lesser degree than the sites previously discussed in Collar Gulch and near Whiskey Gulch. The "Upper Tail Holt" workings are too small to be used for much other than a day or night roost by a small number of individuals. The Tail Holt Mine appears too cold and humid for use other than a hibernaculum. Current human activity may make it unsuitable for even that purpose, although bats are present in the area and probably enter the mine on occasion.

Table 2. Bat specimens collected from the Judith Mountains, Fergus County, Montana. Museum abbreviations are for Montana State University (MSU) and the University of Kansas Museum of Natural History (UKNHM).

SPECIES ¹	COLLECTION NUMBER	LOCATION	DATE
MYLU	MSU 4908	Judith Mtns., N of Lewistown	4 August 1955
MYLU	UKMNH 86116	7 mi. N, 9 mi E of Lewistown, Judith Mtns. [Maiden area]	2 July 1961
MYVO	UKMNH 83738	3 mi. N of Maiden, Judith Mtns.	27 July 1960
LANO	UKMNH 86150	7 mi. N, 9 mi E of Lewistown, Judith Mtns. [Maiden area]	4 July 1961
LANO	UKMNH 83749	3 mi. N of Maiden, Judith Mtns.	27 July 1960
EPFU	UKMNH 86151	7 mi. N, 9 mi E of Lewistown, Judith Mtns. [Maiden area]	4 July 1961
EPFU	UKMNH 83744	3 mi. N of Maiden, Judith Mtns.	27 July 1960
LACI	UKMNH 83756	3 mi. N of Maiden, Judith Mtns.	27 July 1960
COTO	UKMNH 86158	7 mi. N, 9 mi E of Lewistown, Judith Mtns. [Maiden area]	3 July 1961

¹ MYLU (Little Brown Myotis, *Myotis lucifugus*), MYVO (Long-legged Myotis, *Myotis volans*), LANO (Silver-haired Bat, *Lasiorycteris noctivagans*), EPFU (Big Brown Bat, *Eptesicus fuscus*), LACI (Hoary Bat, *Lasiurus cinereus*), COTO (Townsend's Big-eared Bat, *Corynorhinus townsendii*).

Bat Species of the Judith Mountains: Little survey work has been conducted over the years to determine the bat fauna of the Judith Mountains. Seven species of bats have been documented, six of which were collected by 1961 (Table 2, Hoffmann et al. 1969) and one species (Western Long-eared Myotis, *Myotis evotis*) reported first during the 1997-1999 surveys. Each of these species has been documented in the nearby Little Rocky Mountains in Phillips County (Hendricks 1998, Hendricks et al. 2000).

Of the seven species so far documented, the three species captured during the 1997-1999 inventory (Western Long-eared Myotis, Long-legged Myotis, Townsend's Big-eared Bat) are USFWS "species of concern" and deserve special management consideration. Each species has been documented over-wintering in caves and mines elsewhere in Montana (Swenson and Shanks 1979, Hendricks et al. 2000), Idaho (Genter 1986), South Dakota (Choate and Anderson (1997), and Wyoming (Priday and Luce 1997). Of the other four species documented in the Judith Mountains, Little Brown Myotis and Big Brown Bat use caves and mines (as well as suitable buildings) as hibernacula, and both species have been reported hibernating in Azure Cave in the Little Rocky Mountains (Hendricks 1998, Hendricks et al. 2000). The Silver-haired Bat and Hoary Bat usually roost in trees and buildings, rarely in caves or mines (van Zyll de Jong 1985, Nagorsen and Brigham 1993, Harvey et al. 1999).

Three additional bat species might reasonably be expected to occur in the Judith Mountains, although not necessarily regularly in each case, nor necessarily in large numbers. Two of these, Western Small-footed Myotis (*Myotis ciliolabrum*) and Yuma Myotis (*M. yumanensis*) are also USFWS "species of concern" (Harvey et al. 1999). Western Small-footed Myotis has been captured at Azure Cave in the Little Rocky Mountains (Hendricks et al. 2000), and has been found hibernating in abandoned mines in Musselshell and Richland counties in eastern Montana (Swenson 1970, Swenson and Shanks 1979). Yuma Myotis has been collected in Choteau and Powder River counties and uses mines for maternity sites elsewhere (Betts 1997); both species will probably be recorded in the Judith Mountains eventually. Eastern Red Bat (*Lasiurus borealis*), the third potential species, may migrate through the Judith Mountains area, especially along riparian corridors with cottonwoods. This species was only recently confirmed in Montana, from Hill and Custer counties (Kristi Dubois pers. comm.).

MANAGEMENT CONSIDERATIONS

- 1) Security of Tate-Poetter Cave against unauthorized entry is a high priority, since the cave is a known hibernaculum for Townsend's Big-eared Bat, a BLM Special Status species in Montana. The cave is currently in a relatively pristine state, and there is little evidence of vandalism, perhaps because of the difficulty of entering the cave. Although gating of the cave is not warranted at this time, entry should be limited to summer (late-May to early September) to minimize disturbance to bats during fall swarming and winter hibernation (see Thomas 1995). Routine visits to the cave site by BLM personnel should be conducted to monitor activity, and a logbook at the site should be installed so records of visitation can be maintained.
- 2) The mine workings in Collar Gulch opposite Tate-Poetter Cave ("Collar Gulch Adits") should be protected with bat-friendly gates (Tuttle and Taylor 1994, Dalton and Dalton 1995, Hendricks 1999) to ensure minimal disturbance to bats using the site as a day and night roost. To maintain airflow within the working, none of the three portals should be sealed during any reclamation activities at this site. The site currently appears little disturbed by recent human activity. However, given that at least two bat species using the site are USFWS "species of concern" (former C2 candidates for listing under the Endangered Species Act), proactive management may be called for in this situation.
- 3) Tate-Poetter Cave, the "Collar Gulch Adits", and the small cave to the west of these ("Collar Gulch Cave") should be resurveyed and routinely monitored for use by bats (perhaps every second or third year for Tate-Poetter Cave), because each is a known Townsend's Big-eared Bat site. The documented diversity of bats using each site is likely incomplete, however. A system of routine monitoring will help determine timing and magnitude of bat use at each site. If funding permits, a study of radio-tagged Townsend's Big-eared Bats may be desirable to document movements and habitat use within Collar Gulch. These data would provide the best basis for future bat management activity in this sensitive area of the Judith Mountains.
- 4) Additional monitoring of bat activity at the Whiskey Gulch Mine is advised for the reasons discussed above; survey work at this site is incomplete and other species are likely to use it. This site should be monitored (trapped) in spring and summer, and revisited in autumn. The gates currently in place on portals #1 and #2 allow passage of bats, but each could be breached by a determined human, as it would be relatively easy to break a hole in the brick and mortar walls supporting each gate. Replacement of each by a more secure gate design should be considered.
- 5) Surveys for bats at other abandoned mine workings and caves on BLM lands should be conducted. Emphasis should be on summer and autumn, when bats are most active, and winter, when hibernacula can be identified. Few mine sites may be accessible or used by bats, but they should not be neglected if reclamation is anticipated for abandoned mine workings. Surveys in the North and South Moccasin Mountains should also be conducted. At least one cave (apparently on BLM land) in the South Moccasin Mountains is reported to be a hibernaculum for an unidentified species of bat (Campbell 1978).

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Appendix 1. Species, sex, age, and size of bats captured (mist-netted) during abandoned mine and cave surveys on BLM lands in the Judith Mountains, Fergus County, Montana in 1999.

Species ¹	Date	Time	Site (#)	Sex	Age	Forearm Length (mm)	Weight (g)
MYEV	16-Sep	20:20	Whiskey Gulch Mine (2)	M	Ad	37.2	9.3
MYEV	16-Sep	20:24	Whiskey Gulch Mine (2)	M	Ad	38.9	9.0
MYEV	16-Sep	20:50	Whiskey Gulch Mine (2)	M	Ad	37.1	8.0
MYVO	12-Sep	20:05	“Collar Gulch Adits” (10)	M	Ad	37.9	7.2
MYVO	12-Sep	20:05	“Collar Gulch Adits” (10)	M	Ad	40.0	8.0
MYVO	12-Sep	20:10	“Collar Gulch Adits” (10)	M	Ad	39.0	8.2
MYVO	12-Sep	20:25	“Collar Gulch Adits” (10)	M	Ad	39.0	9.8
MYVO	12-Sep	20:42	“Collar Gulch Adits” (10)	M	Ad	39.0	9.4
MYVO	12-Sep	20:45	“Collar Gulch Adits” (10)	M	Ad	38.0	8.8
MYVO	12-Sep	20:49	“Collar Gulch Adits” (10)	M	Ad	37.9	8.2
COTO	12-Sep	19:57	“Collar Gulch Adits” (10)	M	Ad	43.4	10.2

¹MYEV (Western Long-eared Myotis, *Myotis evotis*), MYVO (Long-legged Myotis, *M. volans*), COTO (Townsend’s Big-eared Bat, *Corynorhinus townsendii*).